R E S T R I C T E D C I R C U L A T I O N

This paper is not an official document; it is for information only and must not be quoted in any printed publication.

Agricultural Memorandum No 713

WEATHER FOR SUGAR BEET IN 1974

J B TYLDESLEY

1. BACKGROUND. Yields of sugar beet in 1974 were generally low. Attacks of the disease known as "virus yellows" were widespread, but the season's weather has also been blamed for the poor crop. The object of this note is to assess the likely contribution of the weather.

2. WEATHER CRITERIA. Sugar beet is a crop which has a lot of photosynthesis to do to produce the required carbohydrate, and therefore available solar energy is important. Dr R Gloyne has found (unpublished work) that once certain disturbing factors (such as virus yellows) are allowed for, sugar yields are closely related to the total potential evapotranspiration (PET) from April to September inclusive. This arises because the PET is itself a good measure of the available solar energy. The relation breaks down if the crop is acutely short of water, as for instance in 1959. Gloyne suggests that the relation of sugar yield to PET is valid if the total April-September rainfall is greater than about 10 inches (254mm).

3. POTENTIAL EVAPOTRANSPIRATION. Monthly values of PET for 1954-1974, estimated by a method based on Penman's formula, were provided by the Agricultural Branch of the Meteorological Office. Totals for May-September in each year were found. For the twenty years 1954-1973, means and coefficients of variation were calculated for each county in England where sugar beet occupies more than 1% of the total land surface. The deviation of 1974 PET from the average of the previous twenty years was also found in each case.

The results are given in table 1, (which also gives the rank of 1974 PET in the twenty-one years) and show that 1974 was not in any sense exceptional. All the quantities given may be mapped and show consistent patterns. That of deviation of the 1974 PET from the 20 year mean may be described as follows. In coastal parts of Essex and Suffolk, PET in 1974 was about 1% below average. In S Cambridgeshire and West Suffolk, and also in the coastal parts of Yorkshire and Lincolnshire, it was 5-7% above average. Elsewhere in the beet growing areas, it was 0-5% above average.

4. RAINFALL. As it was thought unlikely that the 1974 rainfall for April-September was below the limit of about 250mm suggested by Gloyne, only a few representative rainfall stations were examined, as shown in table 2.

TABLE 2. Rainfall April-September 1974 (mm)

Station	April	May	June	July	Aug	Sept	Total April-Sept
Leeming, N Yorks	22	24	43	67	61	77	294
Finningley, S Yorks	13	25	56	63	65	83	305
Waddington, Lincs	7	24	54	100	81	57	323
Cambridge (Botanic Garden)	10	20	57	15	76	89	267

Table 2 confirms that the seasonal rainfall was adequate overall, though at Cambridge not by a very large margin. There is no doubt however, that the very low rainfall in April and May was inimical to germination and establishment.

5. DISCUSSION. The evidence presented above indicates that on balance, the weather of 1974 was not unfavourable to sugar beet. Despite the early dryness, overall rainfall was adequate. Available energy, as indicated by the potential evapotranspiration, was at least near to average and over wide areas rather above. Therefore the first attribution of low sugar yields to disease (including sub-clinical levels of disease not showing overt symptoms) may well be correct.

Any comments or suggestions on this paper should be sent to the author.

Meteorological Office
Ministry of Agriculture, Fisheries and Food
Windsor House
Cornwall Road
Harrogate
North Yorkshire
HG1 2PW

March 1975.

TABLE 1. Potential evapotranspiration May-September in sugar beet growing areas.

Unit: inches of water.

Area	1954-73		% deviation of 1974 from mean	rank of 1974 in the 21 years
	mean	coeff of variation		
Yorkshire, E Riding, North	14.4	6.2	+ 4.3	5
E Riding, South	14.5	7.6	+ 6.5	4
Nottinghamshire, North	15.5	6.4	+ 2.8	6
South	15.0	6.7	+ 2.2	5
Lincolnshire, North-west	14.9	6.6	+ 2.6	6
North-east	14.9	7.7	+ 5.1	5
Central	15.4	6.0	+ 2.5	7
South	15.4	7.3	+ 4.0	5
Rutland	15.6	6.9	+ 2.1	8
Huntingdonshire	15.2	6.3	+ 1.2	9
Cambridgeshire, North	15.2	7.2	+ 3.1	6
South	15.6	5.7	+ 7.4	2
Norfolk, West and Central	15.7	6.7	+ 1.0	8
East	15.7	6.1	+ 0.1	9
Suffolk, West	15.7	6.5	+ 7.3	3
North-East	15.6	6.1	- 0.4	11
South-east	16.0	6.7	- 0.5	11
Essex, West	15.6	5.8	+ 3.7	5
North-east	16.2	4.8	- 0.8	8*
South-east	16.0	6.1	- 1.2	10

* NE Essex values refer to years 1961-74 only.